

# MIDTERM REVIEW PROBLEMS

1. Provide the correct SI unit for each measurement below.

a. Length

m

b. Mass

kg

c. Volume

m<sup>3</sup>

d. Density

kg/m<sup>3</sup>

2. Perform the following conversions.

a. 1.04 cg to dag

0.00104 dag

b. 0.6 kg to cg

60000 cg

c. 0.005 dg to hg

0.00005 hg

d. 102 mg to g

0.102 g

3. Determine the number of significant figures in the following numbers.

a. 101.204

6

c. 1010

3

b. 0.003050

4

d. 15

2

4. Express the following numbers in scientific notation and round them to three significant figures.

a. 1089

$1.09 \times 10^3$

b. 0.0004356

$4.36 \times 10^{-4}$

c. 20

$2.0 \times 10^1$

5. Perform the following calculations reporting your answers with the correct number of significant figures.

a.  $(2.40 \times 10^{-4})(2 \times 10^7)$

$5 \times 10^3$

e.  $57.8792 + 4.6$

62.5

b.  $\frac{3.0 \times 10^{-2}}{6.0 \times 10^{-3}}$

$5 \times 10^0$

f.  $27 \times 4$

100

c.  $4.1 \times 10^8 + 6.8 \times 10^7$

$4.8 \times 10^8$

g.  $(357.2)/4.5$

79

d.  $5.6 \times 10^{-3} - 7 \times 10^{-4}$

$5 \times 10^{-3}$

7. Perform the following conversions using the factor label method. Report all of your answers in scientific notation to one decimal place and don't forget to include units.

1.0 kg = 2.2 lbs

1.0 L = 34.0 oz

3 ft = 1 yd

1 kg = 1000 g

1.0 L = 1000 mL

1000 mg = 1 g

5280 ft = 1 mile

1.0 m = 1.13 yds

a. How many milligrams are equal to 3.0 kg?

$$3.0 \text{ kg} \left( \frac{1 \times 10^6 \text{ mg}}{1 \text{ kg}} \right) = 3.0 \times 10^6 \text{ mg}$$

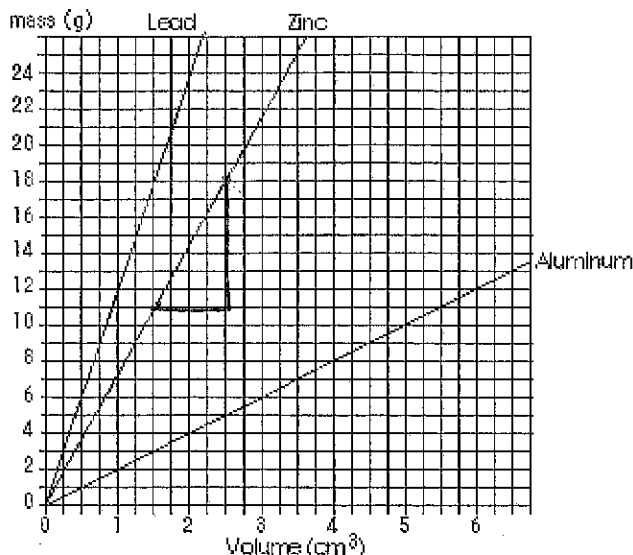
b. There are about 25 miles between Upper Dublin and Philadelphia. How many meters are in between the two?

$$25 \text{ mi} \left( \frac{5280 \text{ ft}}{1 \text{ mi}} \right) \left( \frac{12 \text{ in}}{1 \text{ ft}} \right) \left( \frac{2.54 \text{ cm}}{1 \text{ in}} \right) \left( \frac{1 \text{ m}}{100 \text{ cm}} \right) = 40233.6 \text{ m}$$

- c. The density of Titanium (Ti) is 4.5 g/mL. Convert this density to lbs/oz.

$$\frac{4.5g}{mL} \left( \frac{1kg}{1000g} \right) \left( \frac{2.2lb}{1kg} \right) \left( \frac{1000mL}{1L} \right) \left( \frac{1L}{34.0oz} \right) = 0.316/oz$$

8. Determine the density of zinc from the graph.



Density of Zn =  $7g/cm^3$

$$\text{density} = \frac{\Delta y}{\Delta x} = \frac{7}{1} = 7g/cm^3$$

9. A block of wood has a mass of 180grams. It is 10.0cm long, 6.0cm wide, and 4.0cm thick. What is its volume in cubic centimeters and density in grams per cubic centimeter?

$$D = \frac{m}{V} \quad V = L \times W \times h$$

$$\frac{180g}{10cm \times 6cm \times 4cm} = 0.75g/cm^3$$

10. What is the volume of a sample of tin that has a mass of 1.3 cg and a density of 9.1 g/cm³?

$$D = \frac{m}{V} \quad V = \frac{m}{D}$$

$$1.3cg \left( \frac{1g}{100cg} \right) \left( \frac{1cm^3}{9.1g} \right) = 0.0014cm^3$$

11. Classify the following materials using one of the following terms: *element, compound, homogeneous mixture, or heterogeneous mixture*.

a. Propane gas (C<sub>3</sub>H<sub>8</sub>)

Compound

b. Chocolate chip cookie dough

heterogeneous mixture

c. Helium (He) gas

Element

12. Classify each of the following as a physical or chemical change.

a. Melting of copper physical

b. The burning of wood Chemical

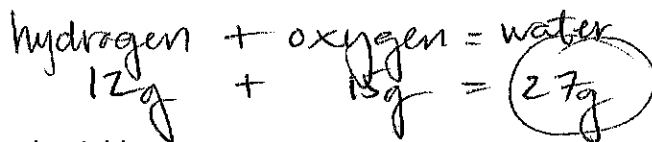
b. Acid corrosion Chemical

d. Evaporation physical

13. If 12 grams of hydrogen combines with 15 grams of oxygen, what is the mass of water formed?

$$\begin{array}{rcl} \text{Hydrogen} & + & \text{oxygen} = \text{water} \\ 12 & & 15 = 27 \end{array}$$

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14. Complete the following table.

ATOMIC NUMBER	MASS NUMBER	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS	GROUP	PERIOD
8	16	8	8	8	16	2
28	59	28	31	28	10	4
20	41	20	21	20	2	4

15. Magnesium has three naturally occurring isotopes. 78.70% of Magnesium atoms exist as Magnesium-24 (23.9850 g/mol), 10.03% exist as Magnesium-25 (24.9858 g/mol) and 11.17% exist as Magnesium-26 (25.9826 g/mol). What is the average atomic mass of Magnesium?

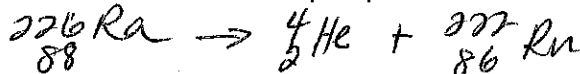
$$\begin{aligned} 23.9850 \times 0.7870 &= 18.876195 \\ 24.9858 \times 0.1003 &= 2.50607574 \\ 25.9826 \times 0.1117 &= 2.90225642 \\ &+ \quad \quad \quad 24.2845 \end{aligned}$$

16. Without doing any math, are there more Bromine-79 atoms or more Bromine-80 atoms on earth? (Hint: look at the periodic table.)

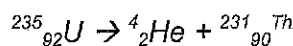
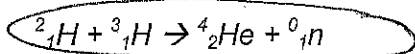
Br atomic mass = 79.904  
 The atomic mass of Bromine is closer to Br-80, which means that Br-80 is more abundant in nature.

17. Complete the following equations and solve the half-life problem below.

a. Write an equation for the emission of an alpha particle from Ra-226.



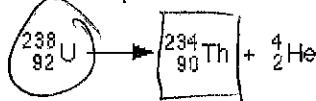
b. Circle the equation that represents nuclear fusion.



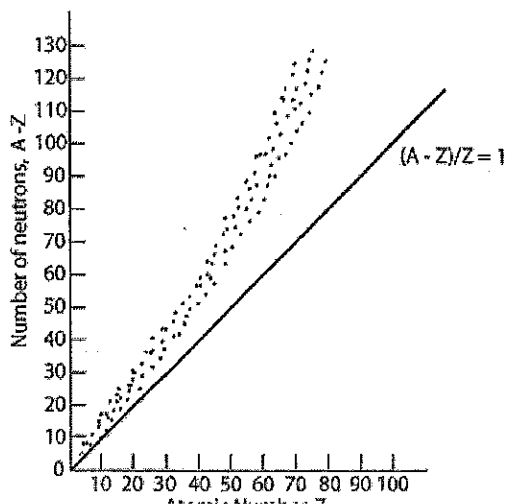
c. What is the half-life of a substance that decays from 12.0 g to 3.0 g in 18 seconds?

$$\frac{\text{Final}}{\text{Initial}} = \frac{1}{2}^n \quad \frac{3.0g}{12.0g} = \frac{1}{2}^n \quad \frac{1}{4} = \frac{1}{2}^n \quad n=2(\# \text{ of half-lives}) \quad 18/2 = 9 \text{ seconds}$$

18. Circle the parent nuclide and put a box around the daughter nuclide.



19. Determine the type of decay that each isotope would undergo (alpha, beta, or electron capture)



Uranium-235 = Alpha

Calcium-38 = ~~EC or Positron~~  $\frac{18}{20}$

Vanadium-53 = Stable

20. Draw the electron-dot structures for the following atoms.

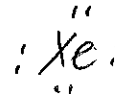
a. Nitrogen



b. Calcium



c. Xenon



21. Use these formulas and constants to solve the following problems. Do not forget to include units and round your answers to the correct number of significant figures.

$$c = 3.00 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ Js}$$

$$E = h\nu$$

$$c = \lambda\nu$$

a. What is the wavelength (in meters) of light with a frequency of  $1.00 \times 10^{20} \text{ Hz}$ ?

$$c = \lambda\nu \quad \lambda = \frac{c}{\nu} \quad \frac{3.0 \times 10^8 \text{ m/s}}{1.00 \times 10^{20} / \text{s}} = \boxed{3.0 \times 10^{-12} \text{ m}}$$

b. What is the energy of a photon of light with a wavelength of  $3.00 \times 10^{-8} \text{ m}$ ?

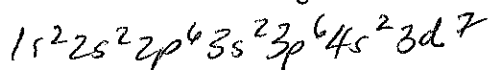
$$E = h\nu \quad c = \lambda\nu \quad E = h\left(\frac{c}{\lambda}\right) \quad 6.626 \times 10^{-34} \text{ J}\cdot\text{s} \left(\frac{3.0 \times 10^8 \text{ m/s}}{3.00 \times 10^{-8} \text{ m}}\right) = 6.626 \times 10^{-18} \text{ J}$$

c. Which of the two waves above has greater energy (a or b)? Support your answer. You can demonstrate this with math or explain it in words.

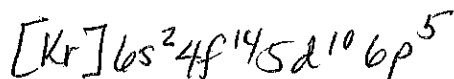
A has a longer wavelength than B. Wavelength and energy are indirectly related so B has more energy.

22. Use the periodic table to answer the following questions.

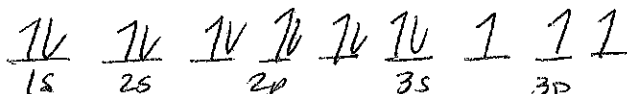
a. Give the electron configuration for Cobalt (Co).



b. Give the electron configuration for Iodine (I) using noble gas notation.



c. Draw the orbital diagram for Phosphorus (P).



23. Fill in the following table. Put an "X" through the ion columns when not needed.

ELEMENT	Would it form a...		Metal, Nonmetal, or Metalloid?	Noble Gas Electron Configuration	Lewis Dot Structure
	Cation	Anion			
Phosphorus		✓	nonmetal		$\cdot \ddot{P} \cdot$
Berkelium	✓		metal	$[\text{Rn}] 7s^2 6d^1 5f^8$	BK
Gadolinium	✓		metal		Gd
Bhrium	✓		metal		Bh
Chlorine		✓	nonmetal		$\cdot \ddot{\text{Cl}} \cdot$
Bhrium		✓	metalloid	$[\text{He}] 2s^2 2p^1$	B

24. Which element has the greatest.....check one element for each trend.

Element	Electronegativity	Ionization Energy	Atomic Radius
Na			
Mg	✓	✓	
K			✓